An Overview of Mites on Grapevine and the Discovery of a New Phytoseiidae Species: *Typhlodromus (Typhlodromus) spiceae*

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Submitted for publication: September 2020
Accepted for publication: March 2021

Key words: Phytoseiidae, *Typhlodromus*, biocontrol, mites, phytophagus

The European grapevine (*Vitis vinifera* L.) is the main species used for wine making, with South Africa being one of the top wine exporting countries. Grapevine is vulnerable to a range of pests, including mites. We present an overview of phytophagous and predatory mites on grapevine in South Africa and describe a new phytoseiid species which was discovered in the winelands region of Wellington, South Africa. Grapevine shoots with leaves were collected over two growing seasons at four farms in Wellington. A nursery, mother block and a commercial vineyard were selected on each farm. The mites were removed with a mite brushing machine and slide mounted. The Phytoseiidae Database, as well the most recent relevant literature were used in confirming the new species. Illustrations of the new species were made using photographs taken by Zeiss Axioskop TM Research that included a Zen Soft Imaging System. The new *Typhlodromus* species, *Typhlodromus (Typhlodromus) spiceae* sp.n., is set apart from closely related species by setae *Z*4 being 0.7 times the length of *Z*5 and by having a short, saccular and thick-walled spermathecal. This species was found together with one phytophagous mite species (*Brevipalpus lewisi*) and several predatory mite species (*Typhlodromus praeacutus, Typhlodromus saevus, Eusieus addoensis*). A key to identify females of the South African species of *Typhlodromus* (*Typhlodromus*) is provided.

INTRODUCTION

The European grapevine (*Vitis vinifera* L.) is the main species of grapevine used for wine making in South Africa. Grapevines are vulnerable to a range of pests, including mites. Mites are the most successful and diverse of the chelicerates (Walter & Proctor, 2013). What makes a mite different to other Arachnida, is that its mouthparts are situated on a separate structure at the front of the body called the gnathosoma. The rest of the body is fused to form the idiosoma (Evans, 1992). Mites have evolved to feed on plants, fungi and bacteria, to being predators, saprophytes, parasites and symbionts (Krantz, 2009). With this, they have managed to occupy a wider range of habitats than any other arthropod group (Krantz, 2009). Their small body size allows them to easily disperse through air and wind currents, and also to be transported by larger animals, a process called phoresis (Krantz, 2009).

Mites occur in all habitats, they play an important role in ecology, and they are also a valuable component in human developments such as agriculture. Mites can be beneficial by preying on agricultural and ornamental crop pests (Gerson, et al., 2003), while non-predatory mites are effective nutrient recyclers. Many are highly detrimental as disease vectors to plants and animals and as serious pests of crops and ornamental plants (Krantz, 2009). Plant parasitism has evolved many times into different lineages of mites so that today the majority of monocotyledons, dicotyledons, coniferophyta and vascular plants are invaded by one or more species of mite (Jeppson *et al*., 1975; Helle & Sabelis, 1985a, b; Lindquist *et al*., 1996). Mites attack many crops, including tropical fruit, deciduous fruit and grapevines, citrus, vegetables, tea, nuts, berries and stored products (Smith Meyer & Craemer, 1999). Some phytophagous mites have also been established as effective weed biocontrol agents (Gerson, et al., 2003).

All the phytophagous mites in the Suborder Prostigmata feed only on fluids (Walter & Proctor, 2013). Predatory Prostigmata have chelate chelicerae which they use to crush their prey to extract their fluids (Walter & Proctor, 2013).

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Acknowledgements: Winetech are thanked for funding this research; we are also thankful to the various growers who allowed us to use their vineyards. ***This work is based on the research supported in part by the National Research Foundation of South Africa (Grant Numbers 126938). Any opinion, findings and conclusions or recommendations expressed in the material are those of the authors and therefore the NRF does not accept any liability in regard thereto.***

The majority of plant feeding Prostigmata have stylet-like mouthparts, ideal for puncturing host plants (Lindquist, 1998) and sucking out plant fluids.

The aim of this article is to give an overview of mites on grapevine in South Africa, to provide context to the importance of predatory mites in viticulture and to describe a new Phytoseiid mite, belonging to the genus *Typhlodromus* Scheuten, found during a survey of mites on grapevines in the Western Cape.

OVERVIEW OF MITES ON GRAPEVINES IN SOUTH AFRICA

Grapevine mite pests

The most common grapevine mite is *Colomerus vitis* (Parenstecher), known as the grapevine budmite. *Colomerus vitis* has a vermiform body with only two pairs of legs. They cause erineum, abnormal hair growth, leaf curl and damage buds (Smith Meyer, 1981). *Colomerus vitis* consist of three physiological races which can only be distinguished by the damage they cause (Smith Meyer, 1981). Tetranychidae (spider mites) is a well-known agricultural pest, including on grapevine (Smith Meyer & Craemer, 1999; Mani *et al*., 2014). Their mouthparts consist of a pair of elongate, extrusible cheliceral stylets (Hislop & Jeppson, 1976). This allows them to puncture plant cells and absorb the leaf cell contents, which in turn, compromises the plant's ability to photosynthesize (Flaherty & Wilson, 1999). Tetranychidae found on grapevine are *Panonychus ulmi* (Koch) (Smith Meyer, 1974; 1981; 1987; Jeppson *et al*., 1975; Annecke & Moran, 1982; Pringle *et al*., 1986; Smith Meyer *et al*., 1990; Botha, 1993), *Tetranychus urticae* Koch, 1836 (Pringle *et al*., 1986; Walter *et al*., 2009) and *Tetranychus ludeni* Zacher (Smith Meyer & Rodrigues, 1966; Coates, 1974; Smith Meyer, 1974; 1981; 1987; 1996; Jeppson *et al*., 1975; Duncombe, 1977; Annecke & Moran, 1982; Botha *et al*., 1986; Smith Meyer *et al*., 1988; 1989; 1990; Du Toit, 1993). Tenuipalpidae are perfectly adapted to lie flat against plant surfaces. They damage their host by feeding and injecting toxic saliva into bud tissues, the epidermal cells of stems, leaves and fruit, thereby acting as vectors for plant viruses (Hao *et al*., 2016; Childers *et al*., 2003). *Brevipalpus californicus* (Banks), *Brevipalpus obovatus* Donnadieu (Smith Meyer & Craemer, 1999) and *Brevipalpus phoenicis* (Geijskes) have been identified as grapevine pests in South Africa (Moutia, 1958; Jeppson *et al*., 1975; Smith Meyer, 1979; 1981; Smith Meyer *et al*., 1987; 1989; 1990; Smith Meyer & Swartz, 1998).

Phytoseiidae as biocontrol agents

Phytoseiids are the best studied group of predatory mites due to their success in controlling mites, whiteflies (Hemiptera: Aleyrodidae) and thrips (Thysanoptera) (Gerson *et al*., 2003). Phytoseiids have been established as effective biocontrol agents for mites in many crops, including vineyards (McMurtry *et al*., 1970; Duso *et al*., 1994; McMurtry & Croft, 1997; Croft, *et al*., 1998; Greco *et al*., 2005; Duso *et al*., 2012; Escudero & Farragut, 2005; Fraulo & Liburd, 2007). Specialist phytoseiid species aggregate in response to pest kairomores and plant volatiles emitted in response to herbivory (Sabelis & Dicke, 1985; McMurty & Croft, 1997). They have the ability to quickly increase their population as a response to the infestations (McMurtry & Croft, 1997; Croft *et al*., 2004). Generalist phytoseiids are considered a more sustainable approach for biological control (Ivancich Gambaro, 1973; McMurtry, 1992; James & Whitney, 1993), due to specialists' tendency to over-populate and over-exploit the pest abundance, leading to emigration and starvation, thereby contributing to unstable prey-predator dynamics (McMurtry, 1992; Nyrop *et al*., 1998; Jung & Croft, 2001). Generalists can move to an alternate food source when pests are absent (McMurtry, 1992; Duso *et al*., 2012), instead of migrating. However, generalist phytoseiids are susceptible to pesticides (James, 1990). Phytoseiids are also efficient at controlling eriophyid mites (also known as bud mites), because they are able to detect them from a distance via the volatiles emitted by infested plants (Dicke, 1988; Dicke *et al*., 1988; Aratchige *et al*., 2004; Liguori, 1988; Engel & Ohnesorge, 1994a, b; Aratchige *et al*., 2004).

Several species of the genus *Typhlodromus* Scheuten are important predators of phytophagous mite populations in orchards and vineyards (Ivancich Gambaro, 1973; Girolami *et al*., 1992; Duso & Pasqualetto, 1993; Duso & Vettorazzo, 1999; Duso, *et al*., 2012; Tixier *et al*., 2013). *Typhlodromus* species vary between specialist and generalist predators (McMurtry & Croft, 1997; McMurtry *et al*., 2013). *Typhlodromus* species are common predators on fruit crops, with some species being effective at controlling pests. *Typhlodromus pyri* Scheuten has been shown to regulate the European red mite (*Panonychus ulmi* (Koch) and the Apple rust mite (*Aculus schlechtendali* (Nalepa) on apple in New Zealand and the United Kingdom (Wearing *et al*., 1978; Solomon *et al*., 1993). *Typhlodromus pyri* in combination with various other predatory mites has also shown potential in controlling eriophyids and tetranychids in Italy (Duso, 1989; Duso & Vettorazzo, 1999). *Typhlodromus pyri* is capable of surviving on alternate food sources like plant sap, fungi spores and pollen (Johnsen & Hansen, 1986; Croft *et al*., 1995; Ripka, 1998, Pozzebon & Duso, 2008; Pozzebon *et al*., 2009). Species of this genus form an important part of integrated pest management (IPM) programs (Croft, 1990; McMurtry & Croft, 1997; Desneux *et al*., 2007). *Typhlodromus exhilaratus* Ragusa and *Typhlodromus phialatus* Athias-Henriot have been recognized as being effective at protecting vineyards in Southern Europe against plant feeding mites (Kreiter *et al*., 2000; De Moraes *et al*., 2004).

Predatory mites are considered an effective method for limiting mite outbreaks (Sentenac *et al*., 1993). Pesticides that kill beneficial predatory mites should only be considered as a last resort for pest control (Smith Meyer, 1996). Where mite pests are not effectively controlled by their natural enemies, integrated control can be implemented (Smith Meyer, 1996).

A major factor that leads to the use of phytoseiids as biocontrol agents in IPM and integrated mite control (IMC) programs, is the ability of spider mites to develop resistance to pesticides (Smith Meyer, 1996; McMurtry, 1982; Helle & Sabelis, 1985a, b; Smith Mayer, 1996).

For the sustainable and efficient control of mites, it is crucial to positively identify each pest species, recognize

the damage it causes, know its biology and life history and understand the seasonal occurrence and basic strategy required for its control (Smith Meyer, 1996).

MITE COLLECTION

Samples of grapevine, *Vitis vinifera* L. were collected on farms in the vicinity of Wellington (-33.936179; 18.862899) in the Western Cape, South Africa during a survey on mite diversity in vineyards. Exact locations are withheld to protect the identity of the growers. Each farm contained a commercial vineyard, mother block and nursery. Ten random vine branches and sub-branches were collected at each block. Samples were separately packaged in sealed plastic bags, returned to the laboratory and kept in the refrigerator (10 °C) until further inspection.

In the laboratory the vine leaves were run through a mite brushing machine (Fig. 1); the machine (Leedom Engineering) has two brushes that comb the mites off the leaf onto a Perspex plate. The plate was then examined under a stereo microscope and mites were collected into 70% ethanol. Mites were cleared in lactic acid and slide mounted in PVA solution following the general protocols in Krantz & Walter (2009). Mites mounted on microscope slides were dried in an oven at 45-50 °C for 24 hours. The mites were identified using a compound microscope with phase contrast and measured with a Zeiss Image Analysing System, Zen 2.3 lite.

DESCRIPTION OF A NEW PHYTOSEIIDAE SPECIES

During the mite diversity survey, a new Phytoseiidae (genus *Typhlodromus*) species was found. Line drawings were made of the new species from photographs of the specimens taken with a Zeiss Axioskop TM Research microscope equipped with a Zen Soft Imaging System and measuring tools. All illustrations were edited using Adobe Illustrator C5**.** All measurements were in micrometers (µm). Dimensions are listed for the holotype, with variations of paratypes in brackets. The Phytoseiidae database by Ferragut & Ueckermann (2012), Stathakis *et al*. (2012), Demite, *et al.* (2014) and Tixier *et al*. (2016) were used in confirming the new species. The setal notations adopted were those of Lindquist & Evans (1965), as adapted by Rowell *et al.* (1978) for the dorsum. The idiosomal setal pattern follows Chant & Yoshida-Shaul (1992).

Type specimens were deposited in the National Collection of Arachnida (NCA) in Pretoria, South Africa.

The family Phytoseiidae consists of 2521 species in 94 genera (Demite *et al*., 2020), representing 3 subfamilies. The new species belongs to the subfamily Typhlodrominae Wainstein with 732 described species in 23 genera and the genus *Typhlodromus* Scheuten consisting of two subgenera; *Typhlodromus* (*Typhlodromus*) and *Typhlodromus* (*Anthoseius*).

The subgenus *Typhlodromus* is defined as follows: Dorsal setae j1, j3, j4, j5, j6, J2, z2, z3, z4, z5, Z4, Z5, s4, s6, S2, S4, r3 and R1 present (S5 absent). Ventral setae JV1, JV2, JV3, JV4, JV5, ZV1, ZV2, ZV3 present. JV3 present or absent. Setae S5 are absent. Z4 and S4 are transversely aligned.

***Typhlodromus (Typhlodromus) spicae* sp.n.**

FEMALE (N = 6) (Fig. 2):

Dorsum (Fig. 2 (1); Table 1): Dorsal shield 322 (316 – 330) long and 162 (160 – 181) wide. With 4 pairs of solenostomes. Idiosomal setal pattern 12A: 7A and JV: ZV (Chant & Yoshida-Shaul, 1992). Setae ji 22 (19 – 23), j3 31 (30 – 32), j4 16 (16 – 20), j5 16 (16 – 20), j6 22 (19 – 23), J2 20 (23 – 25), J5 5 (6-7), z2 22 (18 – 22), z3 26 (23 – 29), z4 24 (24 – 31), z5 19 (18 – 20), Z4 47 (47 – 55), Z5 69 (69 – 71), s4 30 (31 – 33), s6 35 (34 – 37), S2 39 (39 – 43), S4 41 (40 – 46), r3 21 (21 – 27), R1 30 (24 – 30). Setae serrate, except j1, j4, z5 smooth, and J5 and R1 sometimes smooth. Peritreme extending to level between j3 and z2.

Venter (Fig. 2 (2-3); Table 1): Sternal shield mostly smooth, with few lateral striae; posterior margin with medium lobe; distances between ST1 – ST2 31 (31 – 37), ST2 – ST2 57 (56 – 60). Genital shield smooth; distance between ST5 – ST5 54 (54 – 60). Ventrianal shield striate, pentagonal, with anterior margin straight, 96 (96 – 108) long, 84 (84 – 99) wide at level of ZV2, 77 (74 – 88) wide at level of anus, pre-anal pores absent. Caudoventral setae JV5 smooth 60 (54 – 63).

Spermatheca (Fig. 2 (4); Table 1): Calyx saccular with distal half thick walled 15 (15-16). Atrium incorporated in calyx.

FIGURE 1
The Leedom engineered leaf brushing machine.

 DOI: https://doi.org/10.21548/42-1-4297

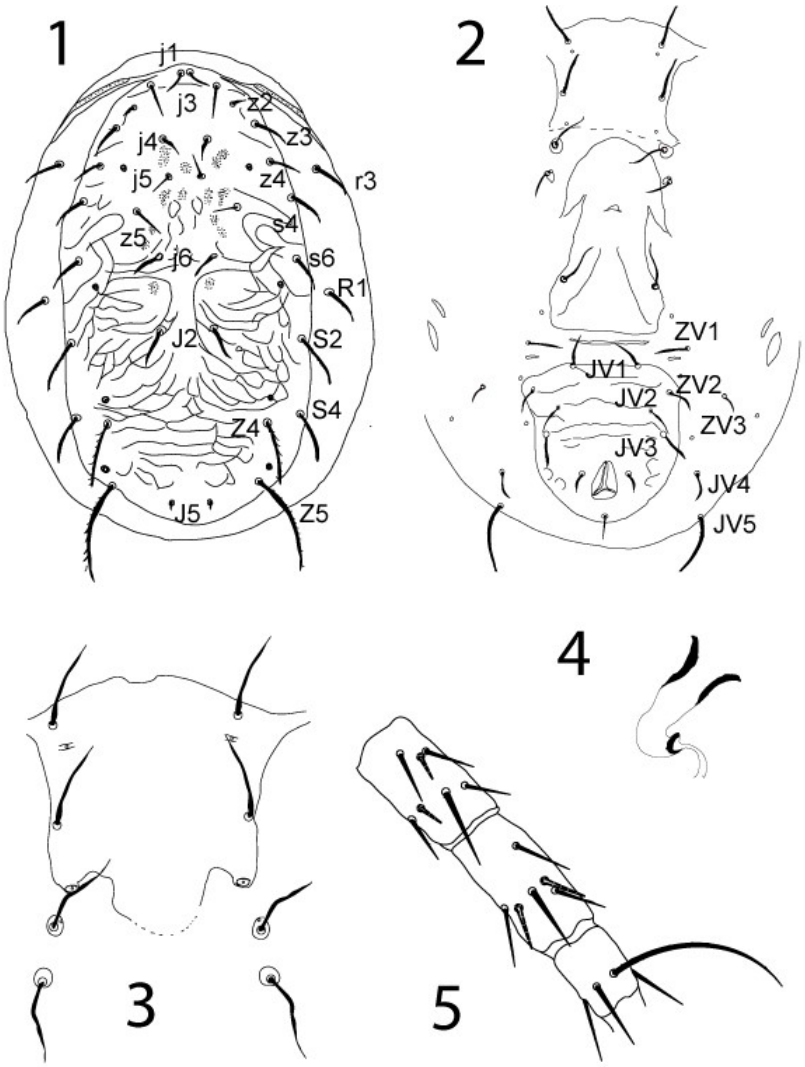

FIGURE 2
Typhlodromus (typhlodromus) spiceae sp.n. with dorsal (1) and ventral (2) view of idiosoma. Spermatheca (4) and genu, tibia and tarsus of leg IV (5).

Chelicerae. The position of the chelicerae renders an illustration impossible, but movable digit apparently with 2 teeth and fixed digit with 4 teeth and a pilus dentilis.

Legs (Fig. 2 (5); Table 1): Macrosetae sharp-tipped: Sge IV 25, Sti IV 25, St IV 46 (42 – 50). Chaetotaxy: genu II 2-2/0, 2/0-1; genu III: 1-2/1, 2/0-1.

Type material

The holotype female and five paratype females were collected from *Vitis vinifera* L. Two females were collected near Wellington (34° 24'1.50'' S; 19° 13'43.13'' E) in a mother block. The other five females were also collected near Wellington, but in a commercial vineyard. All specimens were collected by the first author.

DISCUSSION

This new species, *Typhlodromus (Typhlodromus) spicae* sp.n., belongs to a group of species with 4 pairs of solenostomes (gd*2, gd6, gd8,* gd9) on the dorsal shield, ventrianal shield pentagonal and without preanal pores. We reduced the 29 species with similar characters to 23 based on synonyms and possible synonyms suggested in Ferragut & Ueckermann (2012); Stathakis *et al*. (2012); and Tixier *et al*. (2016).

Typhlodromus (T.) spiceae **sp.n**. differs from the other 23 species as follows: *T.* (*T*.) *octogenipilus* Kreiter *et al*., *T.* (*T*.) *sirikariensis* Stathakis *et al*., *T.* (*T*.) *antakyensis* Stathakis *et al*. and *T.* (*T*.) *mazarii* Allam *et al*. have eight setae on genu II (seven in new species). *T.* (*T*.) *setubali* Dosse and *T.* (*T*.) *moroccoensis* Denmark have six setae on genu II. In *T.* (*T*.) *laurae* Arutunjan and *T.* (*T*.) *knisleyi* Denmark setae Z4 are 0.5 times the length of Z5, but in *T.* (*T*.) *spicae* **sp.n**. Z4 is about 0.7 times the length of Z5. It also differs from these two species in the shape of the spermatheca, which is saccular and thick walled in the two species, but tube-like/saccular with only distal half thick walled in the new species.

The calyx of the spermatheca of *T.* (*T*.) *personatus* Karg, *T.* (*T*.) *bichaetae* Karg and *T.* (*T*.) *cotoneastri* Wainstein is proximally slender, tube-like and flared distally, but in the new species it is saccular/tube-like with only distal half thick walled. Calyx of spermatheca of *T.* (*T*.) *exhilaratus* Ragusa and *T.* (*T*.) *atlanticus* Ferragut with a short neck and small bulbous atrium, setae j1 and j3 subequally long and

TABLE 1
Comparisons between measurements (in µm) of the specimens (total six, all female) of *Typhlodromus (typhlodromus) spiceae* sp.n.

	Holotype	Para species (Female) (slightly damaged)	para (F)	para (F)	para (F)	para (F)
Length of dorsal shield	322	317	316	330	318	306
Width of dorsal shield	162	174	167	168	181	160
st1 - st2	31	37	35	31	34	32
st2 - st2	57		56	60	61	60
st5 - st5	54	58	60	56	55	55
Ventral anal plate	96	108	105	103	107	140
B. Zv2 - Zv2	84	87	85	99	89	92
B. Anal opening	77	74	81	84	85	88
JV5	60	63	61	58	54	57
st IV	46	47	43	50	42	52
sti IV	25	24	24	24	24	28
sge IV	25	23	23	27	25	24
j1	22	23	20	19	20	19
j3	31	31	31	32	30	32
j4	16	18	17	19	17	20
j5	16	18	20	19	18	18
j6	22	22	23	23	19	22
J2	20	23	24	24	25	24
z2	22	18	18	19	19	18
z3	26	28	23	29	26	27
z4	24	26	27	26	25	31
s4	30	32	33	33	33	31
s6	35	34	34	38	38	37
S2	39	41	41	40	39	43
S4	41	40	46	41	43	40
Z4	47	50	55	50	48	47
Z5	69	71	69	71	70	69
J5	5	6	6	7	6	7
z5	19	20	18	19	19	20
r3	21	22	25	27	28	27
R1	30	26	24	26	25	26
Spermatheca	15	16	16	15	16	15

peritreme reach to level between setae j1 and j3, but, in the new species the atrium is incorporated in the saccular calyx, setae j3 are longer than j1 and the peritreme reach to between *j3* and *z2*. *Typhlodromus* (*T.*) *atlanticus* further differs in that setae Z4 are clearly shorter than distance to Z5 and the latter two setae are also shorter than those in the new species, 27-33 and 36-41 versus 47-55 and 69-71, respectively. Calyx of spermatheca of *T.* (*T.*) *beglarovi* Kuznetzov and *T.* (*T.*) *olympicus* Papadoulis & Emmanouel is also with a short neck and small bulbous atrium which differs from that of the new species as already mentioned previously. Both these two species further differ from *T.* (*T.*) *spiceae* **sp.n**. in that setae Z4 are clearly shorter than the distance to setae Z5, instead of extending to Z5. Thus, the distance between Z4

 DOI: https://doi.org/10.21548/42-1-4297

and Z5 are greater compared to other species where there is little difference in length between Z4 and Z5. The following nine species resemble the new species in that the calyx of the spermatheca is without a neck or constriction between it and the atrium. However, *T.* (*T.*) *klimenkoi,* Kolodochka differs from them all in the short peritreme reaching to a level between setae z3 and z4 and in that the peritreme is not uniformly stippled but only with a central core. *Typhlodromus* (*T.*) *tiliae* Oudemans differs from the new species in that setae Z4 is shorter than the distance to Z5 and peritreme reach to a level between z2 and z3 (j3 and z2 in new species). *Typhlodromus* (*T.*) *floresiensis* Ferragut, *T.* (*T.*) *morelllensis* Ferragut and *T.* (*T.*) *mutatus* Kolodochka can be distinguished from the new species in that setae Z4 are also shorter than distance to Z5 and setae Z4 and Z5 are clearly shorter, 40 (19-30) and 70 (36-47), respectively. The bell-shaped calyx of the spermatheca, setae j1 and j3 equally long and shorter setae Z4 (33-36 vs 47-55) and Z5 (50-54 vs 69-71) distinguish *T.* (*T.*) *erensti* Ragusa & Swirski from the new species.

The peritreme extending to between setae j1 and j3 versus j3 and z2 in new species, shorter setae Z4 (38 vs 47-55) and Z5 (54 vs 69-71) and short, broad, thick walled and tubular calyx of spermatheca of *T.* (*T.*) *phialatus*, Athias-Henriot separate it from the new species. The new species, however, is similar to *T.* (*T.*) *athiasae* Porath & Swirski, but the long, thick-walled tubular calyx of the spermatheca distinguishes it from *T.* (*T.*) *spiceae* **sp.n**., only the distal half of the calyx of the latter is thick walled.

Typhlodromus (*Typhlodromus) spiceae* specimens were collected together with other phytoseiidae, namely *Typhlodromus praeacutus preaecutus* van der Merwe, *Typhlodromus saevus* van der Merwe and *Euseius rubicolus* (Van der Merwe & Ryke),) as well as a phytophagous mite, *Brevipalpus lewisi* McGregor (Tenuipalpidae). The fact that is was found on only two of the four farms sampled and that it was less abundant than the other phytoseiid species in the mite samples may explain why it has only now been identified. Another contributing factor is that farmers and pest management consultants generally only note the presence of predatory mites when monitoring pests on grapevines and do not bother to identify individual species.

Many factors play a role in mite predator colonialization of grapevines. It has been shown that grapevine leaf morphology influences predator settlement and can therefore affect interspecific competition (Duso & Vettorazzo, 1999). This aspect was not investigated in this survey. The type of adjacent vegetation that provide a refuge in winter during grapevine dormancy can also influence which predatory mite species occur and even their relative abundance (Sentenac, *et al*., 2002). The vegetation adjacent to the vineyards sampled in this survey was not specifically identified or sampled, therefore no conclusions can be drawn regarding the influence of this vegetation on the species composition or relative abundance in the sampled vineyards. Winter cover crops in vineyards can also provide refuges for predatory mites during grapevine dormancy. In view of the findings of other research, e.g. Sentenac, *et al*. (2002), the type of cover crop, the presence or absence of prey species on the cover crops and predatory mite species prey preference will determine the role that cover crops play in maintaining predatory mite populations in vineyards.

In the South African context, the identification of a new predatory mite, *Typhlodromus spicieae,* is important because the benefits for biocontrol of having a complex of predatory mite species versus a single species has been demonstrated. Interspecific competition between predators tend to have a healthy outcome on predator prey dynamics within the community, as the coexistence of two or more predators in a community enhances the chances of controlling a pest (McMurtry *et al*., 1970; Croft & McRae, 1992; Rosenheim *et al*., 1995). Phytoseiid mites are categorized according to food preference, which consists of four main catagories (McMurtry & Croft, 1997; McMurtry *et al*., 2013). The genus *Typhlodromus* tend to be either Type Ib or IIIa. Type IIIa are considered generalists that feed on mites that prefer a habitat of pubescent leaves, while type Ib are specialist precators of web-producing *Tetranychidae* (McMurtry *et al.*, 2013). *Eusieus* De Leon live according to the type IV lifestyle – pollen feeding generalist predators (McMurtry *et al.*, 2013). The predatory mites found with *T. spiceae* vary between Tetranychidae specialists (Type Ib) and generalist feeders (Type Ia). Based on current information, it is not possible to determine the feeding habitat of *T. spiceae*.

Brevipalpus lewisi is a new grapevine pest in the Western Cape (Saccaggi & Ueckermann, 2018). At present it is unclear what its predators are (Saccaggi *et al*., 2017) and if *T. spicieae* could potentially be preying on *B. lewisi*.

The persistence of different predatory species in a vineyard confirm that they have the capacity to survive on a variety of prey, successfully propagate and compete with other predatory mites (Duso & Vettorazzo, 1999). No miticides were applied in the vineyards used for this survey and the only mite prey species present in the samples was *B. lewisi.* This, together with the abundance of predatory mites in the samples of this survey indicate that phytophagous mites such as *Tetranychidae* were being suppressed to undetectable levels.

Further research is required to determine what *T. spiceae* feeds on, as this will indicate its role in biocontrol, and more extensive surveys are needed to establish its distribution on grapevines in South Africa. Knowledge about the population dynamics of Phytoseiidae in South African vineyards is limited and aspects that need investigation include the effect of adjacent vegetation and cover crops on species composition and relative abundance of predatory mite populations in vineyards.

Etymology

This species name refers to the cat, Spice, of the senior author.

Key to South African species of *Typhlodromus* (*Typhlodromus*) – Females

1. Preanal pores absent; dorsal setae short and mostly smooth 2
- Preanal pores present; dorsal setae long and mostly serrate *T. (T.) magdalenae* Pritchard & Baker

2. Dorsal shield with 5 solenostomes; setae Z4 smooth; peritreme extending to a level between setae j1 and j3; ventrianal shield clearly narrower across anal opening; macroseta on tarsus IV (St) 24 *T. (T.) griekwensis* Schultz
- Dorsal shield with 4 solenostomes; setae Z4 serrate; peritreme extending to a level between setae z2 and j3; ventrianal shield almost squarish; macroseta on tarsus IV (St) 46 ***T. (T.) spiceae* sp.n.**

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